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COMPOSITION, ABUNDANCE, AND TIMING OF POST-BREEDING MIGRANT LANDBIRDS AT YAKUTAT, ALASKA

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ABSTRACT.—The eastern Gulf of Alaska coastline is suspected of providing an important pathway for birds migrating to and from Alaska. Because no intensive study of landbird migration has been conducted in this region, we used mist nets to study the post-breeding migration of landbirds along the coast from 1994 through 1999. Over six post-breeding periods, we netted for a total of 316 days (23,538 net-hr) and captured 13,490 individuals of 46 species (57.3 birds/100 net-hr). Six species constituted >65% of all captures (ordered by abundance): Orange-crowned Warbler (*Vermivora celata*), Hermit Thrush (*Catharus guttatus*), Lincoln's Sparrow (*Melospiza lincolnii*), Ruby-crowned Kinglet (*Regulus calendula*), Fox Sparrow (*Passerella iliaca*), and Yellow Warbler (*Dendroica petechia*). Most birds captured (71%) were Nearctic-Neotropical migrants, and percentages of hatching-year (HY) birds varied from 51 to 90% among common species. Daily capture rates of all species were highest between mid-August and mid-September. Migration of HY individuals preceded that of after-hatching-year (AHY) birds in 70% of the Nearctic-Neotropical species. Masses of HY Nearctic-Neotropical migrants were significantly less than those of AHY individuals. High capture rates and consistent annual use indicate that the eastern Gulf of Alaska coast is an important pathway for many small landbird migrants, particularly Nearctic-Neotropical species, departing breeding grounds in southern Alaska. *Received 5 April 2004, accepted 23 May 2005.*

Birds are subjected to many physical and behavioral challenges when they migrate. Because of the costs associated with undertaking these twice-annual movements, how birds respond to migration challenges has a profound effect on their population dynamics. Despite the critical role migration plays in their annual life cycles, knowledge about the migration biology and ecology of many birds, particularly of small landbirds, remains only rudimentary throughout North America (Moore et al. 1995, Hutto 1998, Moore 2000). Information on small landbird migration in northern North America is particularly depauperate; relatively few studies of the migration of small landbirds have been conducted anywhere in Alaska (but see Bailey 1974, Manuwal and Manuwal 1979, Gibson 1981, Cooper and Ritchie 1995, Benson and Winker 2001).

Isleib and Kessel (1973) suggested that the eastern Gulf of Alaska coastline is an important pathway for landbirds migrating to and from Alaska. Although some waterfowl species initiate spring over-water crossings of the Gulf of Alaska from the coast of the western United States and Canada, radar observations confirm that most birds migrate within a 20-km band offshore of British Columbia and southeastern Alaska (Myres 1972). The close proximity of tall (>3,000 m) mountains to the coast probably restricts inland passage of migrants; however, major river systems that bisect coastal mountains likely funnel some coastal migrants into and out of breeding grounds in interior Alaska, Yukon, and British Columbia (Isleib and Kessel 1973, Patten 1982). Although the migration of shorebirds, waterfowl, and raptors in the region has been somewhat studied (e.g., Patten 1982, Swem 1983, Andres and Browne 1998), virtually no information exists that describes migration patterns of small landbirds. Therefore, we undertook a study to determine the species and age composition, abundance, and timing of post-breeding, small landbirds that migrate along the eastern Gulf of Alaska coastline.

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METHODS

The Yakutat Foreland (Foreland) is located along the Pacific coast of Alaska and extends 140 km southwesterly from the town of Yakutat (59° 30′ N, 139° 50′ W) to Cape Fair-

TABLE 1. Effort and captures during mist netting of post-breeding landbird migrants at Yakutat, Alaska, 1994–1999.

Year	Number of nets	Days (%)[a]	Total net-hr	Birds captured	Capture rate[b]
1994	10	87	3,217	2,217	68.9
1995	11	78	3,306	1,359	41.1
1996	13	80	3,593	1,962	54.6
1997	13	85	4,215	2,122	50.3
1998	15	88	4,565	3,225	70.6
1999	15	83	4,642	2,605	56.1
All years		83	23,538	13,490	57.3

[a] Percentage of possible days (1994 = 54 days, 1995–1999 = 65 days) nets were operated.
[b] Birds/100 net-hr.

weather (58° 48′ N, 138° 00′ W). This glacial plain varies in width from 30 to 70 km and is bounded on the east by the St. Elias Mountains and Brabazon Range and on the west by the Gulf of Alaska. The Foreland is characterized by sandy beaches, extensive sand dunes, tidal mudflats, deciduous shrublands, spruce forests, and muskegs and is transected by a series of relatively short, mostly clear-running rivers (Patten 1982). Most of the area is administered by the U.S. Forest Service as part of the Tongass National Forest.

We established a banding station 1.6 km west of the Yakutat airport (59° 30′ N, 139° 40′ W). The site was primarily open (65%) and vegetated by bryophytes, grasses, sedges, forbs, and sweetgale (*Myrica gale*); patches of willows (*Salix* spp.) and solitary Sitka spruces (*Picea sitchensis*) were interspersed throughout. A dense perimeter of Sitka spruce, alder (*Alnus* spp.), willow, and ferns bounded two sides of the study area.

Post-breeding landbirds were captured in mist nets. Initially, 10 nets (12 × 2.6 m, 30-mm mesh) were erected and placed at ~50-m intervals; additional nets were added in subsequent years (Table 1). Most nets were placed in scattered shrub patches, and a few were set in the dense perimeter of spruce and alders. Overall, our mist nets sampled a total area of about 7.5 ha. From 1 August to 4 October (except for 1994 when we ended netting on 23 September), nets were opened daily at sunrise (with a minimum starting time of 04:30 AST) and operated for an average of 6 (1995–1999) or 7 hr (1994). Nets were operated in intermittent and light rain, but not in heavy rain or when wind was >26 km/hr. Netting ended by 14:00 and was not initiated on days when weather delayed opening the nets until after 11:00. Two to four trained observers checked nets at 30-min intervals. Captured birds were removed and transported to a central processing station where standard morphological data, as described by Ralph et al. (1993), were collected. Age was determined primarily by degree of skull ossification and secondarily by diagnostic plumage characteristics; all species could be reliably aged if skull pneumaticization was incomplete (Pyle et al. 1987, Pyle 1997). To facilitate rapid processing on high capture days, we sometimes only recorded age and sex. We used available morphological descriptions (metrics and plumage) to determine whether migrants originated from coastal or interior Alaska populations (Gabrielson and Lincoln 1959, Pyle et al. 1987, Gibson and Kessel 1997, Pyle 1997). Overall mist-net mortality was <0.3%; most deaths were attributable to inclement weather or predation by mink (*Mustela vison*), ermine (*Mustela erminea*), or red squirrels (*Tamiasciurus hudsonicus*).

Our analysis was restricted to landbird species within the Apodiformes, Piciformes, and Passeriformes. Nomenclature follows the American Ornithologists' Union (1998) check-list and subsequent supplements. Total numbers, capture rates (birds/100 net-hr), and proportions of all captures were calculated for each species across all years. The coefficient of variation (CV = 100 × SD/mean) of annual capture rates (1995–1999, when capture periods were similar) was used to assess between-year variation. We included handled birds that escaped before banding in calculating overall capture rates but excluded captured individuals that were previously banded. To assess occurrence of species not sampled by mist nets, we kept a daily record of all species observed while mist netting. Lastly, we categorized species, according to migration distance, as Nearctic-Neotropical migrants, Nearctic-Nearctic migrants, or residents.

We calculated the proportion of hatching-year (HY) individuals captured for species where >30 individuals were aged. We determined species-specific median passage dates for all HY, after-hatching-year (AHY), and total individuals, and the ranges of dates that included 90% of captures of all ages. Due to the large numbers of individuals that occurred on the same dates, we used a chi-square statistic, corrected for continuity, to test for age-related differences in passage timing by comparing the number of individuals in each age-class that fell above and below the median passage date for each species. We used a *t*-test, with Satterthwaite's approximation of degrees of freedom (Snedecor and Cochran 1980:97), to compare median passage dates of Nearctic-Neotropical species and Nearctic-Nearctic species and to compare mean mass between HY and AHY birds. Lastly, we used weighted least-squares regression to evaluate the relationship between mass ratios (HY: AHY; response variable) and migration-distance categories (Nearctic-Neotropical > Nearctic-Nearctic > resident).

RESULTS

From 1994 through 1999, we captured 13,490 individuals of 46 landbird species (57.3 birds/100 net-hr). An additional 11 species were observed but not captured. Annual capture rates varied between 41.1 and 70.6 birds/100 net-hr (Table 1). Kinglets, Hermit Thrushes, wood-warblers, and sparrows were most frequently captured, whereas corvids, woodpeckers, American Robins, Varied Thrushes, and finches were observed more often than captured (Table 2, Appendix). Six species individually represented ≥5% of all birds captured and together constituted 65% of the all captures (Table 2). Several species (Steller's Jays, Common Ravens, Chestnut-backed Chickadees, Golden-crowned Kinglets, American Robins, and Varied Thrushes) were recorded on a high percentage of days, but they may have represented repeated observations of locally breeding individuals or residents rather than new observations of passage migrants (Table 2). For 40% of the species encountered, either we captured <10 individuals or they were observed on <10% of the mist-netting days (Appendix).

Twenty-seven species that were observed or captured, and 71% of all captures, were Nearctic-Neotropical migrants (n = 23 species). Another 17 species were Nearctic-Nearctic migrants (18% of all captures, n = 13 species), and 13 species (11% of all captures, n = 11 species) were resident. Coefficients of variation (CV) of annual capture rates for regularly occurring species were generally <50% (Table 2). Red-breasted Nuthatches were captured only in 1994 but were observed in moderate numbers other years. Sixty-two percent of all fringillids were captured in a single year (1998), and these species—known to be irruptive—had some of the highest CVs for inter-annual capture rates (Table 2).

Where readily discernible, morphometric measurements and plumage characteristics indicated that migrants captured at Yakutat originated from coastal Alaskan populations (Hermit Thrush, Orange-crowned Warbler, Fox Sparrow, and Song Sparrow). Four recaptures linked Yakutat to other locations along the Pacific coast: (1) a Yellow-rumped Warbler recaptured at Redding, California; (2) a Song Sparrow re-sighted at Juneau, Alaska; (3) a Fox Sparrow recaptured at Long Beach, Washington; and (4) a Golden-crowned Sparrow banded at Niles, California and recaptured at Yakutat. Additionally, the only Sharp-shinned Hawk (*Accipiter striatus*) we banded in 6 years was recaptured outside of Vancouver, British Columbia, and a Yellow Warbler banded on the Alaska Peninsula was recovered 4 days later on a fishing boat 17 km off Yakutat's coast.

Hatching-year birds dominated captures of most species (Table 2), and proportionally fewer young warblers (65%) were captured than were young sparrows (81%; χ^2 = 228, df = 1, P < 0.001). No consistent patterns of HY captures were evident among species of different migration-distance categories; high (>90%) percentages of young were captured in some species of residents, Nearctic-Nearctic migrants, and Nearctic-Neotropical migrants. Of the 15 rarest Nearctic-Neotropical and Nearctic-Nearctic migrants, the combined percentage of HY birds (91.2%, n = 91 individuals) exceeded that of any individual, common species. The high percentage of adult White-winged Crossbills captured in September 1998 was attributable to their concurrent nesting activity at the site.

Daily capture rates of many small landbird migrants were highest between mid-August and mid-September. However, specific timing differed among species (Table 3). Median passage date of Nearctic-Neotropical migrant species was 12–13 days earlier than it was for

TABLE 2. Abundance of post-breeding, small landbirds commonly caught in mist nets or observed at Yakutat, Alaska, 1994–1999. Coefficient of variation (CV) calculated as SD × 100/mean for species with >10 total captures. Species ordered by migration-distance category.

Species	Total captures[a]	% days observed[a]	Birds/100 net-hr[b]			Hatching-year[b]	
			All years	% of total	CV (%)	%	n[c]
Nearctic-Neotropical migrants							
Alder Flycatcher (*Empidonax alnorum*)	50	6	0.21	0.4	81	76	42
Ruby-crowned Kinglet (*Regulus calendula*)	1,069	80	4.20	7.5	42	83	823
Hermit Thrush (*Catharus guttatus*)	2,016	69	8.37	15.0	28	85	1,679
American Robin (*Turdus migratorius*)	12	63	0.05	0.1	134	—[d]	—[d]
Orange-crowned Warbler (*Vermivora celata*)	2,128	67	9.17	16.4	13	61	1,815
Yellow Warbler (*Dendroica petechia*)	803	29	3.26	5.8	51	66	651
Yellow-rumped Warbler (*Dendroica coronata*)	456	42	1.95	3.5	79	86	388
Townsend's Warbler (*Dendroica townsendi*)	16	2	0.06	0.1	53	—	—
Wilson's Warbler (*Wilsonia pusilla*)	559	31	2.26	4.0	70	77	449
Savannah Sparrow (*Passerculus sandwichensis*)	529	37	2.25	4.0	38	67	448
Lincoln's Sparrow (*Melospiza lincolnii*)	1,871	67	7.48	13.4	36	89	1,453
White-crowned Sparrow (*Zonotrichia leucophrys*)	86	10	0.37	0.7	54	96	75
Nearctic-Nearctic migrants							
Northern Flicker (*Colaptes auratus*)		13					
Red-breasted Nuthatch[e] (*Sitta canadensis*)	81	43	0.33	0.6	245	72	65
Brown Creeper (*Certhia americana*)	26	9	0.07	0.1	59	—	—
Winter Wren (*Troglodytes troglodytes*)	97	23	0.35	0.6	27	62	84
Varied Thrush (*Ixoreus naevius*)	106	79	0.40	0.7	40	80	81
American Tree Sparrow (*Spizella arborea*)	25	1	0.12	0.2	103	—	—
Fox Sparrow (*Passerella iliaca*)	898	40	4.05	7.3	75	79	806
Song Sparrow (*Melospiza melodia*)	40	4	0.14	0.3	46	75	28
Golden-crowned Sparrow (*Zonotrichia atricapilla*)	552	18	2.55	4.6	49	74	503
Dark-eyed Junco (*Junco hyemalis*)	548	52	1.60	2.9	33	89	314
Common Redpoll (*Carduelis flammea*)	444	44	2.18	3.9	82	88	394
Residents							
Downy Woodpecker (*Picoides pubescens*)	7	45	0.03	0.1	na	—	—
Hairy Woodpecker (*Picoides villosus*)	1	10	<0.01	<0.1	na	—	—
Steller's Jay (*Cyanocitta stelleri*)	7	85	0.01	<0.1	na	—	—
Black-billed Magpie (*Pica hudsonia*)	0	25	0.00	0.0	na	—	—
Common Raven (*Corvus corax*)	0	86	0.00	0.0	na	—	—
Black-capped Chickadee (*Poecile atricapillus*)	14	6	0.06	0.1	76	—	—
Chestnut-backed Chickadee (*Poecile rufescens*)	218	81	0.85	1.5	56	90	162
Golden-crowned Kinglet (*Regulus satrapa*)	366	75	1.25	2.2	37	91	245
Red Crossbill (*Loxia curvirostra*)	4	30	0.01	<0.1	na	—	—
White-winged Crossbill (*Loxia leucoptera*)	142	23	0.66	1.2	224	2	133
Pine Siskin (*Carduelis pinus*)	275	37	1.28	2.2	199	47	144

[a] 1994–1999 captures or observations.
[b] 1995–1999 captures.
[c] Sample size based on all aged captures.
[d] Not calculated for captures ≤30.
[e] Individuals only captured in 1994.

Nearctic-Nearctic migrant species (combined age classes: t = 2.28, df = 16, P = 0.037). Ninety percent of the Alder Flycatchers, Wilson's Warblers, and Lincoln's Sparrows had passed through Yakutat by 7 September. Except for Lincoln's Sparrow, median passage dates for all other sparrows were later than they were for wood-warblers (Table 3). Male Slate-colored Juncos (*Junco. h. hyemalis*) migrated significantly later than male Oregon Juncos (*J. h. oreganus*; only males could be readily identified to subspecies; χ^2 = 8.31, df = 1, P = 0.004). Except for Winter Wrens, 90% of all individuals of all other Nearctic-Neotropical and Nearctic-Nearctic species had passed through Yakutat by 1 October.

TABLE 3. Passage dates of post-breeding, small landbirds at Yakutat, Alaska, 1995–1999. Only taxa with >30 known-age (hatching-year and after-hatching-year combined) individuals are included. For test between age-class medians, df = 1. Species are arranged by migration-distance category.

Species	All ages		After-hatching-year		Hatching-year			
	Median date	90% date range[a]	Median	*n*	Median	*n*	χ^2	*P*-value
Nearctic-Neotropical migrants								
Alder Flycatcher	16 Aug	4 Aug–4 Sep	9 Aug	10	19 Aug	32	9.18	0.003
Ruby-crowned Kinglet	20 Aug	2 Aug–22 Sep	26 Aug	136	19 Aug	687	11.99	0.001
Hermit Thrush	13 Sep	8 Aug–29 Sep	21 Sep	258	7 Sep	1,421	57.72	<0.001
Orange-crowned Warbler	24 Aug	3 Aug–21 Sep	31 Aug	706	20 Aug	1,109	128.39	<0.001
Yellow Warbler	2 Sep	16 Aug–21 Sep	5 Sep	223	31 Aug	428	40.95	<0.001
Yellow-rumped Warbler	23 Aug	4 Aug–23 Sep	28 Aug	56	21 Aug	332	11.37	0.001
Wilson's Warbler	12 Aug	2 Aug–1 Sep	17 Aug	101	10 Aug	348	17.76	<0.001
Savannah Sparrow	4 Sep	18 Aug–25 Sep	9 Sep	147	3 Sep	301	4.35	0.037
Lincoln's Sparrow	16 Aug	3 Aug–7 Sep	17 Aug	163	15 Aug	1,290	0.58	0.45
White-crowned Sparrow	3 Sep	21 Aug–24 Sep	5 Sep	3	2 Sep	72	0.61	0.43
Nearctic-Nearctic migrants								
Red-breasted Nuthatch	17 Aug	7 Aug–8 Sep	27 Aug	18	17 Aug	47	1.14	0.28
Winter Wren	14 Sep	17 Aug–4 Oct	14 Sep	6	14 Sep	56	0.15	0.70
Varied Thrush	4 Sep	3 Aug–27 Sep	14 Sep	16	4 Sep	65	0.05	0.82
Fox Sparrow	3 Sep	18 Aug–26 Sep	11 Sep	171	3 Sep	635	6.64	0.010
Song Sparrow	28 Aug	14 Aug–20 Sep	28 Aug	7	28 Aug	21	0.00	1.00
Golden-crowned Sparrow	15 Sep	29 Aug–26 Sep	16 Sep	133	15 Sep	370	14.61	<0.001
Slate-colored Junco[b]	18 Sep	26 Aug–1 Oct	20 Sep	2	18 Sep	23	0.37	0.54
Oregon Junco[b]	9 Sep	18 Aug–26 Sep	9 Sep	16	9 Sep	96	0.08	0.77
Common Redpoll	1 Sep	23 Aug–26 Sep	31 Aug	48	1 Sep	346	0.25	0.62
Residents								
Chestnut-backed Chickadee	6 Sep	5 Aug–1 Oct	7 Sep	17	6 Sep	145	0.00	1.00
Golden-crowned Kinglet	2 Sep	2 Aug–30 Sep	25 Aug	23	2 Sep	222	0.17	0.68
White-winged Crossbill	26 Sep	5 Sep–2 Oct	26 Sep	131	2 Oct	2	0.54	0.46
Pine Siskin	4 Sep	9 Aug–30 Sep	5 Sep	76	4 Sep	68	5.35	0.021

[a] Range of dates when ≥90% of all individuals passed through Yakutat.
[b] Only includes males.

TABLE 4. Mass of after-hatching-year (AHY) and hatching-year (HY) birds captured during post-breeding migration at Yakutat, Alaska, 1994–1999. Only species that had ≥10 known-age individuals within each age class are included. Species arranged by migration-distance category.

Species	Mean (g) ± SE (*n*) AHY	Mean (g) ± SE (*n*) HY	*t*-value	*P*-value	HY:AHY mass
Nearctic-Neotropical migrants					
Ruby-crowned Kinglet	6.63 ± 0.04 (114)	6.38 ± 0.02 (540)	6.460	<0.001	0.962
Hermit Thrush	24.84 ± 0.13 (197)	24.45 ± 0.05 (1,225)	2.786	0.006	0.984
Orange-crowned Warbler	9.51 ± 0.03 (484)	9.40 ± 0.03 (636)	2.595	0.010	0.998
Yellow Warbler	10.33 ± 0.06 (178)	9.90 ± 0.05 (291)	5.285	<0.001	0.958
Yellow-rumped Warbler	13.11 ± 0.14 (58)	12.78 ± 0.06 (225)	2.152	0.035	0.975
Wilson's Warbler	7.61 ± 0.05 (103)	7.48 ± 0.03 (245)	2.177	0.031	0.983
Savannah Sparrow	19.65 ± 0.24 (102)	18.97 ± 0.17 (206)	2.268	0.024	0.965
Lincoln's Sparrow	16.21 ± 0.12 (160)	15.77 ± 0.04 (999)	3.414	0.001	0.973
Nearctic-Nearctic migrants					
Red-breasted Nuthatch	10.96 ± 0.11 (17)	10.97 ± 0.14 (34)	−0.049	0.96	1.001
Varied Thrush	83.52 ± 1.76 (13)	82.75 ± 0.61 (59)	0.418	0.68	0.991
Fox Sparrow	36.98 ± 0.36 (75)	36.44 ± 0.18 (347)	1.343	0.18	0.985
Golden-crowned Sparrow	31.20 ± 0.57 (32)	31.15 ± 0.25 (213)	0.075	0.94	0.998
Common Redpoll	12.11 ± 0.34 (10)	12.16 ± 0.09 (89)	−0.151	0.88	1.004
Residents					
Chestnut-backed Chickadee	9.99 ± 0.16 (15)	10.14 ± 0.07 (88)	−0.840	0.41	1.015
Golden-crowned Kinglet	6.07 ± 0.08 (31)	6.29 ± 0.03 (126)	−2.496	0.017	1.036
Pine Siskin	13.04 ± 0.12 (45)	12.80 ± 0.18 (26)	1.081	0.29	0.982

In 70% of Nearctic-Neotropical migrant species, HY birds migrated significantly ($P < 0.05$) earlier than adults (Table 3). Age did not influence migration timing among Lincoln's or White-crowned sparrows, but HY Alder Flycatchers migrated significantly later than adults (Table 3). Among Nearctic-Nearctic migrants, adult Fox ($P = 0.010$) and Golden-crowned ($P < 0.001$) sparrows migrated later than HY individuals. Timing was similar among age classes for the remaining species (Table 3).

Masses of HY birds were lower (all $P \leq 0.035$) than those of AHY birds in all Nearctic-Neotropical migrants (Table 4). The proportional mass of HY individuals, relative to AHY individuals, decreased with increasing migration distance (i.e., migration category, Table 4; weighted least squares: $F_{2,13} = 8.71$, $P = 0.004$, $R^2 = 0.57$). HY individuals of species that migrate to the Neotropics weighed proportionally less than Nearctic migrants, which weighed proportionally less than residents.

DISCUSSION

Mist-net capture rates at our Yakutat banding station were among the highest recorded at post-breeding banding stations in Alaska (see reports at www.absc.usgs.gov/research/bpif/meetings.html), and Nearctic-Neotropical migrants constituted a majority of the captures. Corresponding to the conclusions of Wang and Finch (2002), our mist-net samples were most effective for small landbirds but under-represented larger species (those >50 g). Relatively high capture rates at Yakutat, coupled with the small area we sampled (7.5 ha), support Isleib and Kessel's (1973) assertion that a substantial number of small landbirds undertake a post-breeding migration along the eastern Gulf of Alaska coastline. Additional support is provided by the relatively low inter-annual variation in capture rates of many common species, particularly of Nearctic-Neotropical migrants. Our casual observations suggest that post-breeding landbird migration is widespread across the Foreland's continuous mosaic of shrublands and shrubby meadows.

Species composition of post-breeding birds captured in mist nets and observed during mist netting was very similar to the breeding avifauna of Yakutat (Shortt 1939, Patten 1982, Andres and Browne 2005) and other coastal regions of south-central Alaska (Gabrielson and Lincoln 1959, Isleib and Kessel 1973). Additionally, only coastal forms of Hermit Thrush, Orange-crowned Warbler, and Fox Sparrow were captured at Yakutat. The Gulf of Alaska coastline does not appear to be a major migration route for several common western Alaska species (Alder Flycatcher, Gray-cheeked Thrush, Blackpoll Warbler, and Northern Waterthrush). These species were much more abundant at Fairbanks than at Yakutat during post-breeding migration (Benson and Winker 2001). Alder Flycatchers, however, may have initiated migration prior to our netting effort. The Foreland periodically provides breeding, stopover, and winter habitat for irruptive species. Annual synchrony in capture rates of White-winged Crossbills, Common Redpolls, and Pine Siskins at Yakutat matched synchronous irruption patterns documented in western North America (Koenig 2001).

Off-site recoveries and recaptures, albeit few, suggest that migrants likely continue southward along the Pacific coast of North America. Although waterbirds are known to migrate in spring across the Gulf of Alaska (Myres 1972), the extent to which small landbirds make the same crossing remains unknown; however, the recovery of an HY Yellow Warbler on a fishing boat 17 km off the Yakutat area coastline provides some evidence that small landbirds might be undertaking at least short-distance, over-water crossings. The banding site of that Yellow Warbler was actually to the southwest of Yakutat, suggesting that some migrants may originate from areas to the west and southwest of Yakutat. Large numbers of Wilson's Warblers banded on the Alaska Peninsula did not appear at Yakutat (see reports at www.absc.usgs.gov/ research/ bpif/meetings.html). Additionally, many post-breeding passerine migrants have been encountered 80 km offshore on Middleton Island (59° 43′ N, 146° 30′ W; see fall reports in the serial, *North American Birds*).

In general, age ratios of migrant passerines vary markedly among sites and species (Ralph 1981, Woodrey and Chandler 1997, Woodrey 2000). Our study is one of the first to show consistently greater percentages of young sparrows relative to that of wood-warblers. Greater percentages of HY birds have been captured at Pacific and Atlantic coast sites relative to corresponding inland sites (Murray 1966, Stewart et al. 1974, Mewaldt and Kaiser 1988, Morris et al. 1996, Humple and Geupel 2002). Ralph (1981) suggested that the high proportions of young birds on the coast delineated the periphery of a species' migratory pathway. That HY individuals were predominant (>90%) among captures of the rarest, and hence the most peripheral, species at our coastal Yakutat site supports Ralph's (1981) explanation. For the more common Yakutat species, age ratios are more comparable with those found at inland sites, suggesting that the eastern Gulf of Alaska coastline is a major route for many of the migrant species that we captured. Woodrey and Moore (1997) thought that more balanced age ratios observed along the northern Gulf of Mexico coast were a result of the flight barrier imposed by the open waters of the gulf. Tall mountains along the Gulf of Alaska coastline may impede a general eastward, inland flow of migrants. However, large birds, such as Sandhill Cranes (*Grus canadensis*), are known to use coastal river valleys to access interior migration pathways (Isleib and Kessel 1973, Patten 1982). The magnitude of small landbird migration through these river corridors, however, is unknown.

The greatest number of small landbird migrants pass through Yakutat between mid-August and mid-September. West of Yakutat at Cold Bay, migration also peaked in late August (Bailey 1974). Our daily mist-netting efforts ensured that we did not miss weather-related passages of large numbers of migrants in any given year. Weather, however, assuredly has some influence on the annual variability in capture rates (see DeSante 1983). At Cold Bay, migrants increased with the passage of fronts (Bailey 1974), a pattern we observed casually at Yakutat.

Rotenberry and Chandler (1999) suggested that southerly breeding wood-warblers initiated migration earlier than their counterparts to the north. At Yakutat, male Slate-colored Juncos, which do not breed at Yakutat, arrived much later than Oregon Junco males, which do breed there. Otherwise, the geographic similarity of the breeding avifauna of south-central Alaska and our inability to determine exact breeding origins of post-breeding migrants captured at Yakutat mask any timing patterns influenced by geographic origins of post-breeding migrants.

The earlier passage of Yakutat's Nearctic-Neotropical migrants corresponds with the shorter breeding-range occupancy of high-latitude passerine migrants captured at Fairbanks, Alaska (Benson and Winker 2001). However, some species differed markedly in their migration timing between these two sites; HY Alder Flycatchers, Yellow Warblers, Savannah Sparrows, and White-crowned Sparrows passed through 10–16 days earlier at Fairbanks than they did at Yakutat, whereas HY Ruby-crowned Kinglets and Wilson's Warblers passed through 10–14 days later in Fairbanks. Some Alder Flycatchers and Wilson's Warblers may have passed through Yakutat before netting was initiated on 1 August. Hatching-year Orange-crowned Warblers, Yellow-rumped Warblers, Fox Sparrows, and Lincoln's Sparrows were similar in their migration timing at the two sites; timing patterns of AHY birds were similar to those of HY individuals at both sites.

Differences in age-related patterns of passerine migration generally arise from differences in timing and location (Woodrey 2000). The high percentage (70%) of Nearctic-Neotropical species among which HY birds preceded AHY individuals in migration corresponded to the age-related migration patterns observed at Fairbanks; there, in 64% of Nearctic-Neotropical species, HY birds preceded AHY birds (Benson and Winker 2001). There was complete consistency in the age-related passage of 10 migrant species shared between Yakutat and Fairbanks. Because we operated mist nets on a daily schedule, as did the Fairbanks station, age-related differences in migration timing were not due to temporal differences in sampling effort (Kelly and Finch 2000). Few other sites south of Alaska have shown such consistent age-related patterns in migration timing of short- and long-distance migrants. Mixing of geographically distinct populations at more southern sites may blur age-dependent migration patterns.

Hatching-year individuals may initiate southward movements sooner than adults because they are less efficient in procuring food resources needed to complete migration. Inefficiency is due to inexperience, social and physiological constraints, or some combination of these factors (reviewed by Woodrey 2000). Alternatively, adult birds may delay migration until the completion of prebasic molt (reviewed by Gauthreaux 1982). That masses of many HY Yakutat migrants were less than those of AHY birds suggests that young birds are less efficient at performing their first migration. Mass differences between HY and AHY individuals are generally greatest in long-distance migrants at Yakutat, and at other migration sites (reviewed in Woodrey 2000); masses of resident HY and AHY birds at Yakutat were more equitable. Lower mass, and assumed low fat loads, would cause HY individuals to make shorter flights and hence prolong migration time. Accordingly, age-related differences in migration timing should dissipate as migrants approach their wintering areas and should be greatest nearer their breeding areas.

Clearly, the eastern Gulf of Alaska coastline provides an important pathway for small landbirds undertaking their post-breeding migration southward from Alaska. Because landbird stopover habitats are a fairly continuous element in the landscape matrix of south-central Alaska, we suspect that migratory populations are probably not limited by the amount or configuration of stopover habitat. Maintenance of high quality stopover habitats along the entire migration pathway, however, is needed to ensure successful migration of small landbirds, particularly for those completing their first southward migration.

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APPENDIX. Post-breeding migrants rarely captured or observed at Yakutat, Alaska, 1994–1999. Species arranged by migration-distance category.

Species	Number captured	% days observed
Nearctic-Neotropical migrants		
Rufous Hummingbird (*Selasphorus rufus*)	8	1
Olive-sided Flycatcher (*Contopus cooperi*)	0	1
Yellow-bellied Flycatcher (*Empidonax flaviventris*)	1	0
Warbling Vireo (*Vireo gilvus*)	6	1
Bank Swallow (*Riparia riparia*)	0	1
Barn Swallow (*Hirundo rustica*)	0	4
Gray-cheeked Thrush (*Catharus minimus*)	1	<1
Swainson's Thrush (*Catharus ustulatus*)	2	<1
American Pipit (*Anthus rubescens*)	0	4
Tennessee Warbler (*Vermivora peregrina*)	1	0
Blackpoll Warbler (*Dendroica striata*)	2	<1
Northern Waterthrush (*Seiurus noveboracensis*)	7	<1
Common Yellowthroat (*Geothlypis trichas*)	7	1
Chipping Sparrow (*Spizella passerina*)	1	0
Brewer's Sparrow (*Spizella breweri*)	2	0
Nearctic-Nearctic migrants		
Red-breasted Sapsucker (*Sphyrapicus ruber*)	0	2
Northern Shrike (*Lanius excubitor*)	0	1
White-throated Sparrow (*Zonotrichia albicollis*)	1	0
Lapland Longspur (*Calcarius lapponicus*)	2	4
Rusty Blackbird (*Euphagus carolinus*)	1	9
Brown-headed Cowbird (*Molothrus ater*)	0	<1
Residents		
Northwestern Crow (*Corvus caurinus*)	0	1
Pine Grosbeak (*Pinicola enucleator*)	2	0